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ABSTRACT

This student module on recognizing job safety hazards is one of 50 modules concerned with job safety and health. This module details employee and employer responsibilities in correcting and monitoring safety hazards. Following the introduction, 10 objectives (each keyed to a page in the text) the student is expected to accomplish are listed (e.g., Cite and describe at least five common fire hazards). Then each objective is taught in detail, sometimes accompanied by illustrations. Learning activities are included. A list of references and answers to learning activities complete the module. (CT)

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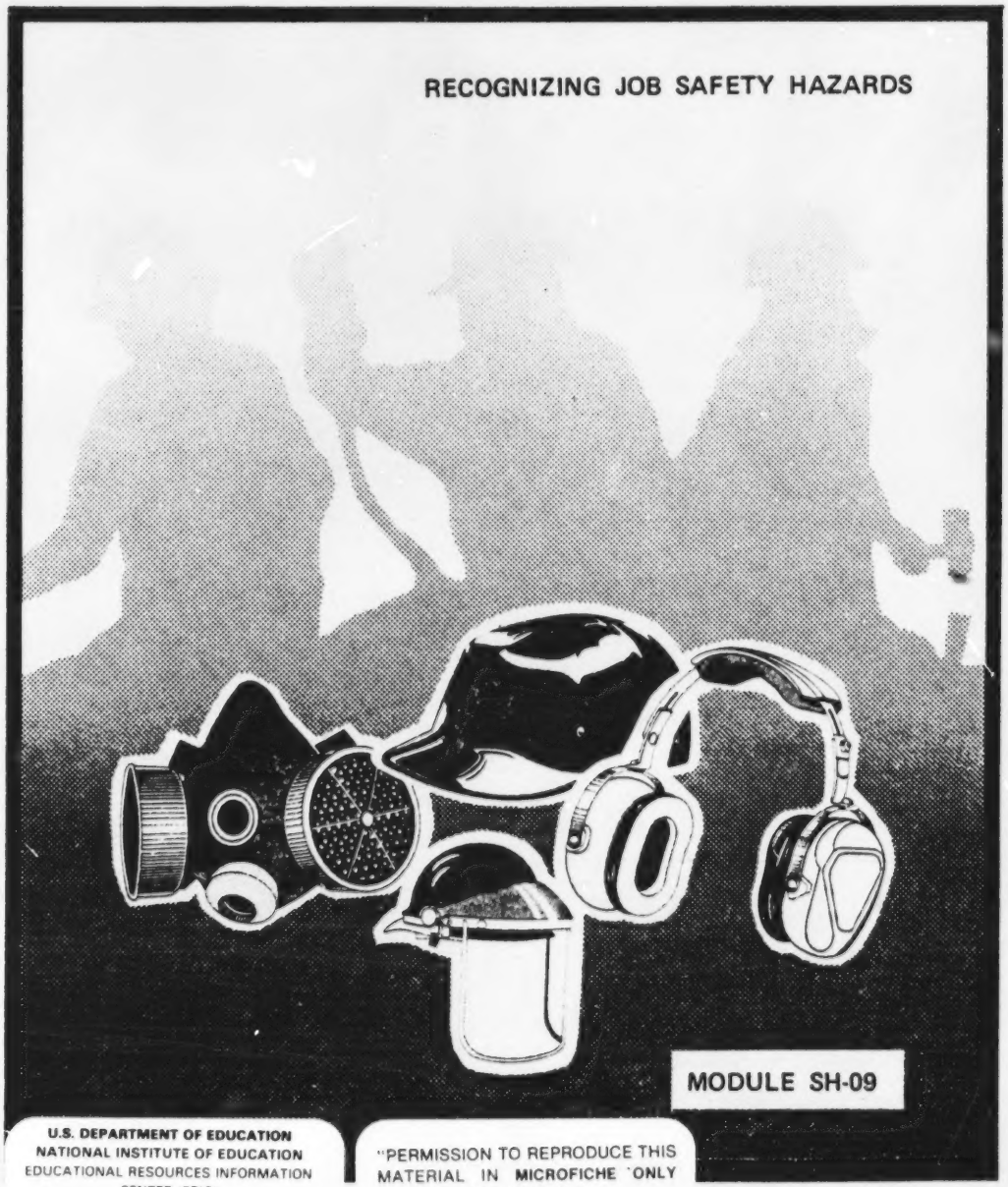
ED213843

SAFETY AND HEALTH

RECOGNIZING JOB SAFETY HAZARDS



MODULE SH-09

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INTRODUCTION

A worker's sixth sense of survival emerges when dangerous tasks are first undertaken. When first encountering any hazardous situation a person tends to work cautiously. During the learning stage, a worker will perform a risky task at a reasonable speed.

Once dangerous tasks become commonplace within a worker's routine, precautions are often omitted or neglected. Safety equipment is discarded or used only occasionally. Work is executed at higher speeds. Tasks are undertaken with inadequate tools, or safeguards are removed from tools in order to speed work. Gradually, previously safe conditions deteriorate until an accident occurs.

Workers performing tasks that are not generally considered hazardous are likely to operate carelessly, too. The tendency seems to be to cut corners on familiar jobs. Unfortunately, even the most common work tasks have hazards that are not obvious to many workers.

It is, therefore, necessary to properly prepare all workers to cope with work hazards so that they can create and maintain a safe work environment. This module identifies the more frequently encountered job hazards. Employee and employer responsibilities in correcting and monitoring safety hazards are detailed, also.

OBJECTIVES

Upon completion of this module, the student should be able to:

1. State the employer's responsibility for control of job safety hazards under the OSHAct. (Page 3)
2. Name seven ways in which accidents can cause economic loss. (Page 5)
3. Define "accident." (Page 6)
4. Identify two categories of job safety hazards and give at least three examples of each. (Page 8)
5. Cite and describe at least five common fire hazards. (Page 10)

6. Name three types of machine hazards and describe two ways of controlling these hazards. (Page 15)
7. Describe the relationship between good housekeeping and eliminating hazards in the workplace. (Page 20)
8. Contrast the hazards associated with lifting material by hand as opposed to using machinery. (Page 22)
9. List four types of hazardous electrical conditions and five types of protection against such dangers. (Page 24)
10. Summarize the employee's responsibility for correcting safety hazards. (Page 27)

OBJECTIVE 1: State the employer's responsibility for control of job safety hazards under the OSHAct.

Accidents occur in nearly every type of work, from construction and heavy manufacturing to service and health care industries. A wide variety of hazards contribute to worker injuries and deaths, including unguarded machinery, improperly maintained electrical equipment, fire hazards, poor housekeeping, and lack of personal protective equipment.

During the 1960s, the accident rate in American industry began to climb dramatically, increasing over a ten-year period to rates 30 percent above those of 1958. The pressure to increase production through new manufacturing processes and greater mechanization contributed to this decline in job safety. In 1970, Congress had to face annual figures such as these:

- Job-related accidents accounted for more than 12,000 worker deaths.
- Nearly 2 1/2 million workers were disabled.
- Ten times as many person-days were lost from job-related disabilities as from strikes.

In terms of lost production and wages, medical expenses and disability compensation, the burden of the nation's commerce was staggering. Human cost was beyond calculation. Therefore, the Occupational Safety and Health Act of 1970 was passed by the United States Congress. The purpose of the Act is "...to assure so far as possible every working man and woman in the Nation safe and healthful working conditions and preserve our human resources." The OSHAct has increased public awareness of occupational hazards and has provided a strong motivation for all companies to pursue safe work practices and conditions. Lack of compliance with OSHA regulations can result in fines for industry, or in cases of imminent danger, actual shutdowns. OSHA regulations require employers to try to find ways to correct hazards by changing their workplace conditions or their work practices. In recent years since the passage of the OSHAct, technology can be found and implemented that will control hazards.

For purposes of instituting safe workplace functions, the role of the employer and the supervisor are considered interrelated. That is, what applies to the employer also applies to the supervisor because the supervisor is the employer's direct representative who maintains the closest contact with the employee.

The fundamental requirement that the OSHAct makes of the employer is to furnish employees a workplace free from recognized hazards that could cause death or serious physical harm. Further, the employer must comply with those OSHA standards that pertain to the specific industry, keep records of work-related injuries or illnesses or deaths, and maintain records of employee exposure to toxic material or harmful physical agents. The employer must not discriminate against employees who file complaints regarding hazardous work conditions.

Employers must correct safety hazards cited by OSHA. If the hazard cannot be eliminated, the use of personal protective equipment may be provided by the employer. The employer is also responsible for training personnel in the use and maintenance of personal protective equipment and in enforcing its use. Employees who fail to use personal protective equipment may be subject to disciplinary action by the employer.

The first-line supervisor of an industrial company is the key resource in the implementation of the management's safety programs. The supervisor must be prepared to correct unsafe acts by the employee. Employers are required to maintain a clean, uncluttered workplace. Employees must not be allowed to work using defective or unguarded machinery, operate equipment without utilizing prescribed personal protective equipment, or work in poorly illuminated or excessively noisy areas. In short, the supervisor must work to protect his employees from hazards and insist that all employees abide by safety rules.

ACTIVITY 1:*

1. State the fundamental requirement that the OSHAct makes of the employer. _____

_____

*Answers to Activities appear on page 30.

2. Check each item in the list below that is a responsibility of the employer under OSHAct.

___ a. To keep records of work-related injuries, illnesses, and deaths.

___ b. To provide personal protective equipment where hazards cannot be eliminated.

___ c. To correct hazards if, and only if, they are identified by employees or become apparent as the result of an accident.

___ d. To maintain a clean, uncluttered workplace.

___ e. To explain hazards and safeguards to employees and allow workers a choice about whether or not to work safely.

___ f. To maintain records of employee exposure to toxic materials or harmful physical agents.

OBJECTIVE 2: Name seven ways in which accidents can cause economic loss.

Work-related injuries and illnesses cost billions of dollars each year, and these costs are absorbed through higher prices and increased taxes. The economic impact of an accident goes far beyond medical expenses and insurance and worker's compensation. Loss of production time occurs not only for the injured worker but also for co-workers who stop to give aid, express sympathy, or compose themselves after the trauma of an accident in their midst. Employee morale often drops when a co-worker is hurt, and lowered morale may be accompanied by absenteeism, turnover, and safety-related strikes.

When an employee is injured, his or her family loses buying power. In cases of death or disablement, welfare payments or rehabilitation costs may be a part of the financial toll of accidents.

Replacement costs of damaged equipment and wasted material must be considered when assessing economic loss due to accidents. Liability, fire, or property insurance premiums are driven up by high accident rates.
In addition to the cost of equipment repair or replacement, the loss in production time resulting from damaged equipment must be added to the cost of the accident.

The costs discussed up to this point are the measurable costs of an accident - the dollars and cents costs. On the other hand the pain and sorrow experienced by accident victims and their families is immeasurable, but if anything even more far-reaching in its effect.

ACTIVITY 2:

List seven ways in which accidents cause economic loss.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____

OBJECTIVE 3: Define "accident."

The word "accident" is usually used to refer to undesired events involving injuries, fatalities, or any other losses. The more detailed definition given below may be helpful in understanding the nature of accidents:

> An accident is any unexpected event that interrupts normal work processes and is caused by human, situational or environmental factors, or a combination of these. It may or may not result in death, injury, or property damage but it has the potential to do so.

Three important points in this definition (adapted from the National Institute for Occupational Safety and Health/OSHA Guide for Supervisors/Instructors) require further explanation. The first point is that an accident

does not have to result in damage, injury, or death. For instance, a worker slips and falls on an oil spot while walking across the floor. The fall does not injure the worker or cause any damage, but it is still classifed as an accident because it interrupts work processes and carries with it the potential for injury and damage.

The second point is that accidents, by their very nature, are unusual, unexpected events. Yet the fact that accidents occur infrequently is not as important as the recognition that the potential for accidents is always present. An oil spot on the floor, for example, may remain there for many days without anyone slipping on it or taking particular notice of it, but that does not reduce the oil spot's potential to cause injury or damage. Unless workers are aware of and fully alert to the ever present possibility of accidents, and unless they act to discover and eliminate potential causes, sooner or later these causes probably will produce accidents in which injury, death, or damage will occur.

The third and perhaps the most important point in the definition is that accidents do not occur without a reason; they are caused. Many people maintain magical beliefs concerning the occurrence of accidents, even though accident investigations usually uncover logical causes.

ACTIVITY 3:

Choose the best answer.

1. Which of the following statements about accidents is not true, according to the definition of accident in this section?
   a. Accidents are unusual and unexpected.
   b. The potential for accidents is always present.
   c. Accidents often occur without reason.
   d. An accident is an accident even if no injuries, deaths, or damages occur.
2. Which of the following is not part of the definition of an accident explained in Objective 3? An accident -
   a. Interrupts work processes.
   b. Is always caused by human factors.

c. Has the potential to cause death, injury, or damage.

d. May or may not cause death, injury, or damage.

OBJECTIVE 4: Identify two categories of job safety hazards and give at least three examples of each.

Frequently, a person performing job tasks is unaware of the associated hazards. New employees should be given instruction in the methods and procedures they are expected to follow to safely perform their jobs. All employees should be urged to ask questions about any part of their work they do not understand. They should be asked also to report anything about their work that seems unsafe, to report all injuries, and to comply with the company's established safety rules.

The principal categories of job hazards are unsafe conditions and unsafe acts or practices. Examples of unsafe acts that contribute to accidents are listed in Table 1 and examples for unsafe conditions are given in Table 2.

TABLE 1. UNSAFE ACTS.

- Operating equipment without authority.
- Operating equipment at unsafe speed.
- Making safety devices inoperative.
- Failure to use personal protective equipment.
- Distracting other workers.
- Poor housekeeping practices.
- Worker horseplay or arguments while working.
- Using an improper tool or equipment.
- Knowingly using a defective tool or equipment.
- Standing under suspended loads.
- Mounting equipment in motion.
- Repairing or maintaining equipment while equipment is operating.
- Improper lifting technique.
- Working at height without safety devices.

TABLE 2. UNSAFE CONDITIONS.

• Unguarded - pinch points on machinery.
• Unguarded - catch points on sharp edges.
• Unguarded - shear points.
• Defective tool or equipment.
• Poor machine design.
• Slippery surfaces.
• Improper lighting.
• Improper ventilation.
• Improper dress/clothing.
• Poor housekeeping.
• Congested area.
• Improper protective equipment.

Frequently, both unsafe acts and conditions contribute toward an accident. A study of 80,000 work injuries in Pennsylvania (as reported in the Accident Prevention Manual) revealed that an unsafe condition was a contributing factor in 98.4 percent of the cases. Unsafe acts were found to be a contributing factor in 98.2 percent of the accidents studied.

The interaction of unsafe acts and conditions in accident situations can be seen in this example: A carpenter working at a construction site cuts off a finger while using an unguarded table saw. The unsafe condition is obviously the unguarded saw. The question arises why was the saw unguarded? Had the employee reported the unsafe condition? Had the supervisor failed to correct the unguarded saw after he was notified? Did the equipment supplier fail to make timely delivery of the guard? A host of questions must be asked to establish the true cause of an accident. The important point here is that the individual workers must analyze their jobs for hazards and report to supervisors conditions that may be dangerous.

Finally, it must be emphasized that "carelessness" alone is not an acceptable reason for an accident. Carelessness is a result of either personal or job factors that affect the worker. The worker may have had inadequate skill, experience, or training for a task. Personal factors, such as family or marital problems, job stress, or day-to-day familiarity with the job and equipment can also dull a person's awareness of potential hazards.

ACTIVITY 4:

Name three unsafe work conditions and three unsafe work practices.

1. Unsafe work conditions:
   a. _____
   b. _____
   c. _____
2. Unsafe work practices:
   a. _____
   b. _____
   c. _____

OBJECTIVE 5: Cite and describe at least five common fire hazards.

The major industrial fire hazards include electrical hazards, smoking, friction, overheated materials and hot surfaces. These five common fire hazards were the cause of over 65% of 25,000 industrial fires that occurred during a recent ten-year period.

Electrical hazards are the leading cause of industrial fires; specifically, this means improper electrical wiring or electrical equipment failures. Most electrical fires could be prevented if properly installed wiring were fully grounded and electrical equipment were checked periodically for satisfactory performance as part of preventive maintenance procedures. Workers not skilled as electricians should not install or maintain electrical wiring and should not tamper with, block, or attempt to bypass fuses or electrical equipment, unless specifically authorized to do so.

Smoking, the cause of 18% of all industrial fires, is also a serious hazard. At most industrial job sites, smoking is limited to specifically designated "smoking areas." Smoking should always be prohibited in woodworking shops, textile mills, flour mills, grain elevators and places where combustible products or flammable liquids are used. "No smoking" signs should be posted in such areas. These warning signs should be obeyed. In

cases where fire hazards are extreme, employees should be prohibited from carrying matches, lighters, or smoking material. Employees should discard matches and smoking materials in a metal container rather than on the floor even in unregulated plants.

A third fire hazard is friction. Friction generates excessive heat, and this heat is the origin of many industrial fires. The causes of such heat buildup through friction are inadequately lubricated or misaligned machinery bearings, power transmission bearings, or shafts. These machines are particularly susceptible to fire in buildings where dust or lint accumulates. The tension adjustment on belt-driven machinery can also contribute to a friction-generated fire. Most fire hazards of the friction-generated type can be overcome by frequent preventive maintenance of machine bearings including repacking bearings when leaking oil is detected and maintaining proper belt adjustment tension.

Overheated materials constitute the fourth major hazard. Materials may become overheated as a result of processes that involve heated flammable liquids or material placed in driers. Even with proper preventive maintenance, such processes can generate excessive temperatures causing ignition of the material. Close monitoring of operating temperatures is essential. Preferably such systems should include automated temperature monitoring with set point alarms to warn operators when the temperature limits of the process are about to be reached. Since a fire cannot occur without adequate fuel, storage of flammable materials should be located well away from sources of ignition.

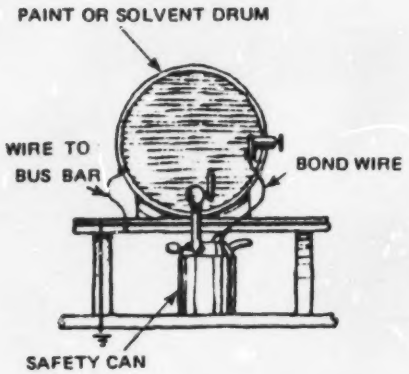

Figure 1. Bonding wire between two metal containers.

Flammable liquids are capable of building up electrical charges when they flow through piping, when they are shaken in a tank or container, or when they are subjected to vigorous mechanical movement such as spraying or splashing. Proper bonding and grounding of the transfer system usually drains off this static charge to ground as fast as it is generated. Figure 1 shows two metal containers with a metal bonding wire between them and a wire to the bus bar, which goes to ground. The bonding wire prevents discharge sparks of static electricity between the two containers.

In Figure 2, the tanks are bonded and grounded. The bus bar is connected to the ground, thus providing a safe path for static charge. Wherever flammable or combustible liquids are transferred from one container to another, both containers must be effectively bonded and grounded to prevent discharge sparks of static electricity.

Figure 2. Drums grounded and bonded.

The fifth major fire hazard is hot surfaces. Fires can initiate from hot surfaces such as boilers, furnaces, hot ducts, irons, electric lamps or hot-processes. These fire hazards can be controlled by keeping potential fuel sources separate from potential ignition sources by isolating them, insulating them, erecting barriers between them, or providing proper air circulation to permit cooling.

In the event that one of the previous hazards generates a fire, the employer must be prepared to cope with the fire. Under OSHAct, employers

are responsible for maintaining a written emergency action plan for fire and other disaster situations. Employers must ensure that all employees know what actions they are expected to take in an emergency. Depending upon the industry, the plan may call for anything from immediate and total evacuation to actual firefighting by employees. Where employees are expected to perform certain tasks during a fire, they must be trained to carry out these tasks. Evacuation routes must be worked out ahead of time, and exits clearly marked.

Fire protection equipment must be a consideration in the employer's fire protection plan. Alarm systems, extinguishers, dry pipe or wet pipe sprinkler systems, fire detection systems, may be part of the employer's plan for fire protection and must be properly installed and maintained.

Different types of fires require different types of extinguishers. Figure 3 shows the symbols used to designate the appropriate extinguisher for each type of fire. The size and placement of fire extinguishers should be conspicuously marked; access to them should be unobstructed, and all personnel should know where they are located. OSHA requires that a designated employee visually inspect the extinguishers monthly to ensure that they are at their proper locations, that they have not been tampered with or actuated, and that there is no corrosion on any metal parts. An annual inspection (usually carried out by the manufacturer or installation company) must be conducted, also. This inspection is more detailed than the visual monthly inspection. A tag should be attached to each fire extinguisher to record the service and inspection dates.

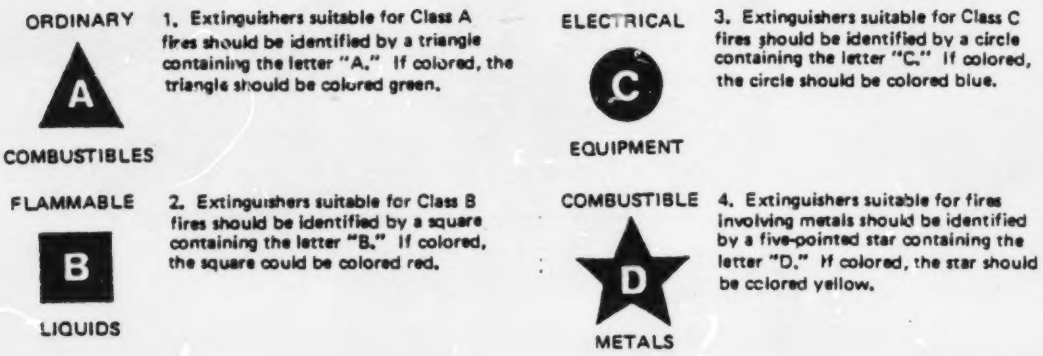
ORDINARY
A
COMBUSTIBLES
1. Extinguishers suitable for Class A fires should be identified by a triangle containing the letter "A." If colored, the triangle should be colored green.
ELECTRICAL
C
EQUIPMENT
3. Extinguishers suitable for Class C fires should be identified by a circle containing the letter "C." If colored, the circle should be colored blue.
FLAMMABLE
B
LIQUIDS
2. Extinguishers suitable for Class B fires should be identified by a square containing the letter "B." If colored, the square could be colored red.
COMBUSTIBLE
D
METALS
4. Extinguishers suitable for fires involving metals should be identified by a five-pointed star containing the letter "D." If colored, the star should be colored yellow.

Figure 3. Types of extinguishers.

ACTIVITY 5:

Match the type of hazard on the left with the sources given on the right. Some hazards will have more than one source given.

___	1.	Electrical hazards.	a. Misaligned machinery bearings.
___	2.	Smoking.	b. Flammable liquid containers not grounded and bonded.
___	3.	Friction.	c. Employee's failure to follow smoking regulations.
___	4.	Overheated materials.	d. Industrial driers.
___	5.	Static sparks.	e. Blocking of fuses.
			f. Failure to discard matches in metal containers.
			g. Inadequately lubricated bearings or shafts.

OBJECTIVE 6: Name three types of machine hazards and describe two ways of controlling these hazards.

An employee who operates machinery or industrial equipment must be aware of the potential hazard of accidentally contacting moving parts of the machine. The result of such contact is usually severe injury and potential permanent disability to the employee. Under the 1970 Occupational Safety and Health Act, regulations require every machine to be guarded at the point of operation or of power transmission to prevent worker contact. Typical points of machinery that are to be guarded are rotating mechanisms (Figure 4), in-running nip points (Figure 5), and common cutting/shearing mechanisms (Figure 6).

Dangerous moving mechanisms create a hazard that is compounded if the operator wears jewelry, a long or loose hair fashion, or inappropriate clothing. Hair is able to penetrate almost any guard, and once caught in machine parts, can draw the worker into dangerous contact. Loose-fitting clothing can be caught up under a guarded machine point also. Finally, jewelry can easily be caught in machnery and cause the person's hand or body to be pulled toward or trapped in a dangerous position. Therefore, workers should not be lulled into a false sense of security, believing that machine guards will protect them regardless of their own carelessness.

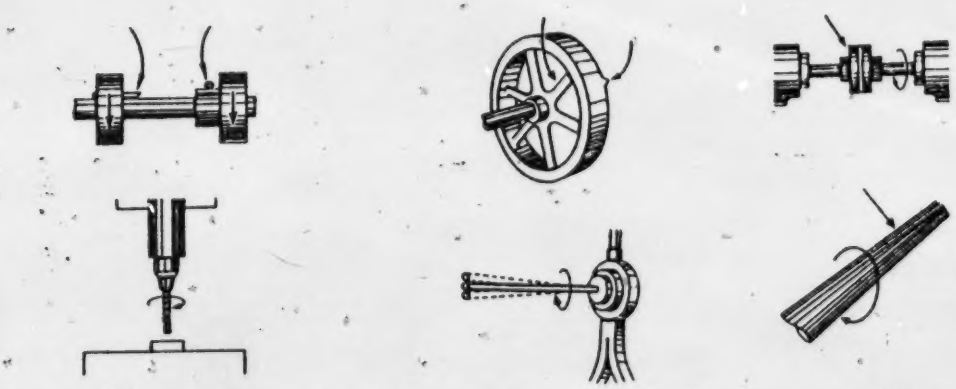

Figure 4. Rotating mechanisms can seize and wind up loose clothing or hair.

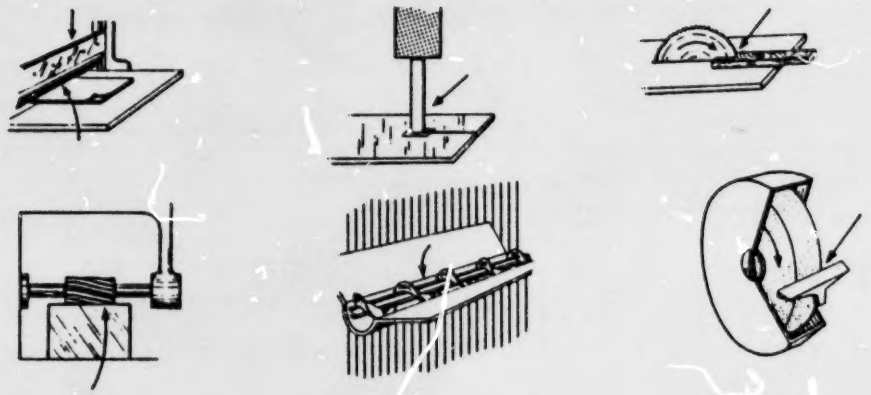

Figure 5. Typical in-running nip points can catch hair or clothing and draw the worker into moving machinery.

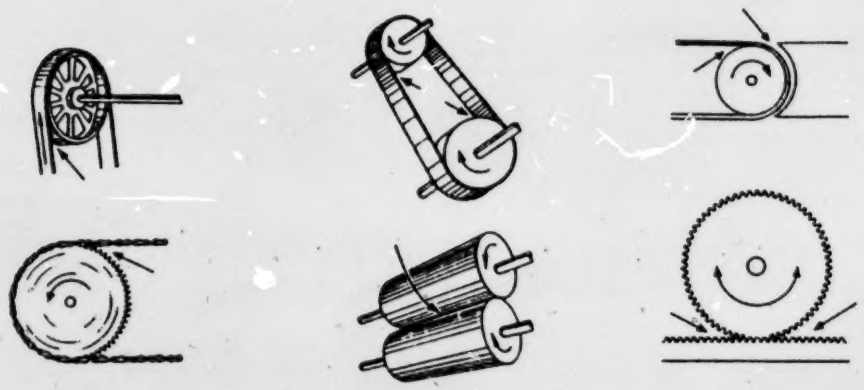

Figure 6. Cutting and shearing machines must be guarded.

Machines are best guarded by building the guard as a component of the machine, and most new equipment is so designed. Unfortunately, a significant amount of equipment that was originally built unguarded is still in existence today. Therefore, it is sometimes necessary to fit guards to existing equipment. The primary method of doing this is to place a barrier between the hazard and the operator and this is achieved by utilizing fixed enclosures, adjustable enclosures, interlocking guards (an electrical switch that shuts down the machine until guard is in place), automatic guards

(travel of machine parts is limited), and remote control. Table 3 lists the methods of guarding, and the actions and limitations of these methods. Representative examples of guards in-place on equipment, are shown in Figures 7 through 9.

TABLE 3. METHODS OF GUARDING ACTIONS AND MOTIONS.

Guarding Methods	Guard Action	Limitations
Fixed enclosure	Barrier or enclosure which admits the stock but which will not admit hands into danger zones because of feed opening size, remote location, or unusual shape. Barrier also used to completely enclose power transmission apparatus or to contain bursting machine parts.	Limited to specific operations. May require special tools to remove jammed stock. May interfere with visibility. Require interlocks for repair or maintenance work.
Adjustable barrier or enclosure	Barrier or enclosure which is adjusted to fit around different sizes or shapes of the die. When adjusted, provides same protection as fixed enclosures.	Often requires frequent adjustment and careful maintenance.
Interlock with electrical or mechanical interlock	Enclosure or barrier shuts off or disengages power and prevents starting of machine when guard is open; prevents opening of the guard while machine is under power or coasting. (Interlocks should not prevent manual operation of "inching" by remote control.)	Requires careful adjustment and maintenance. Operator may be able to make guard inoperative. Does not protect in event of mechanical repeat.

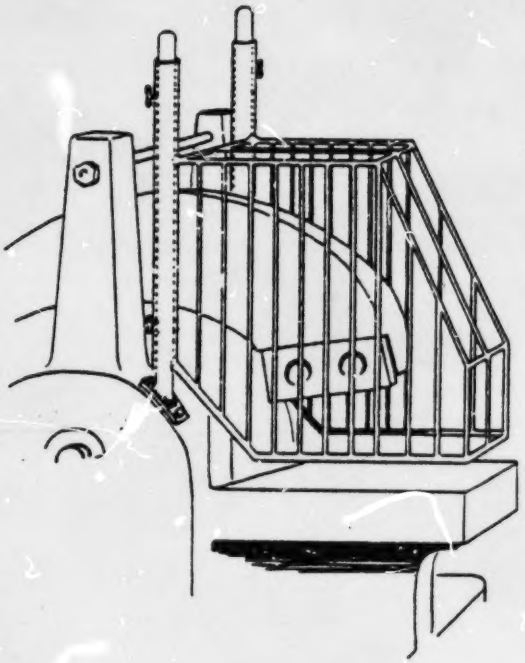

Figure 7. Enclosure guards cutting action of alligator shears.

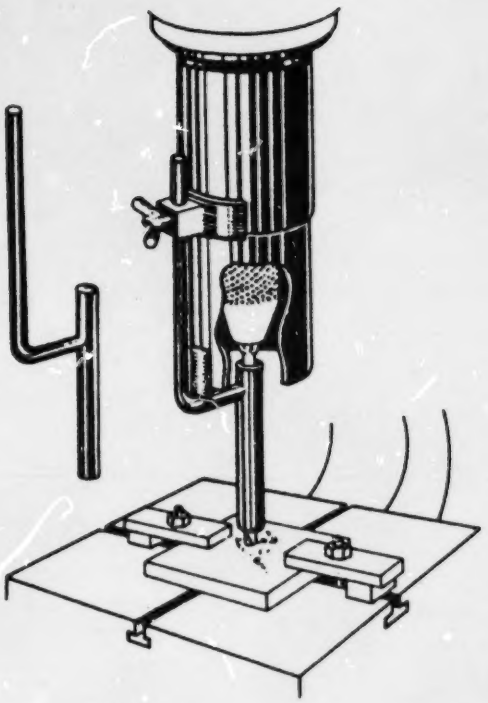

Figure 8. Enclosure covers spindle and drill.

Great care must be taken in adding guards to existing equipment so that the guard does not become a greater hazard than the original circumstance. This is why guards must not be improvised. Rather, a trained engineer or representative from the original manufacturer of the equipment should design the machine guard. Once the guard is in place, it should remain securely attached to the equipment. When it is necessary to remove the guard in order to service equipment, it should be replaced before the machine goes back into operation. Many accidents are caused by failure of workers to replace guards on the equipment after it has been serviced.

Although machine guards can be used to protect workers against direct contact hazards, indirect hazards may require other kinds of protection. For example, the guard may not prevent flying chips from reaching the operator. Nor will a guard prevent contact with cutting oils, fumes or noise that may be associated with operating the equipment.

Figure 9. Lathe guard protects worker from flying chips.

Personal protective devices are often used to control hazards when machine guards cannot offer adequate protection. Protective clothing is used to prevent skin contact with solvents and oils. Ear muffs or ear plugs are used to attenuate the noise from equipment operation where engineering controls have been insufficient to lower the noise levels. Protecting the eyes against flying chips or solvent splash is accomplished by wearing safety glasses, goggles, or face shields. If vapors or gases are emitted from the equipment, it may be necessary to wear a respirator to protect against a specific contaminant.

ACTIVITY 6:

1. Name three types of machine hazards and describe how employee apparel can interact with each hazard.
   a. _____
   b. _____
   c. _____

2. Name two different ways in which machine hazards can be controlled.

a. _____

b. _____

OBJECTIVE 7: Describe the relationship between good housekeeping and eliminating safety hazards in the workplace.

National Safety Council data indicates that falls were the major cause of disabilities and fatalities from industrial accidents in 1972. Undoubtedly most of tne fatalities associated with falls are those that occur where employees are working at heights. However, a large number of disabling accidents are the result of tripping or sliding on the same level, and frequently these occur in offices or other seemingly low-risk work environments. Often these accidents can be traced to poor housekeeping.

Good housekeeping is an essential part of safety in the workplace. Equipment or materials need to be stored or placed out of the way of normal access. Debris or clutter should never be allowed to accumulate in hallways, stairways, or other passageways where it might create a danger of tripping or constitute a fire hazard. Electrical wiring and extension cords are a frequent cause of tripping in office areas; therefore, they should be used sparingly and kept out of access areas.

Containers for storing trash or liquid wastes should have covers unless sanitary conditions can be maintained without lids (as with office trash). Special care should be taken to avoid the build-up of flammable materials such as oily rags, paints, and solvents. All solid and liquid wastes should be removed on a regular and timely basis in order to maintain sanitary conditions. Trash containers should be conveniently located throughout the work area.

Storage rooms or warehousing should be logically organized to permit simple handling and dispatch of material. If material handling equipment is needed, space must be allocated for its storage and movement through aisles. Flammables must not be stored with other materials, but should have

a segregated storage area and distribution point. Storage facilities should be provided for tools, extension cords, air hoses or other equipment when they are not needed for the job at hand.

Work areas or work benches should not be used as places to leave personal belongings or odds and ends of materials. Provision should be made for places outside the work area for employees to leave and secure their personal belongings. (See Figure 10.)

Figure 10. Work areas should not be used as places to leave personal belongings or odds and ends.

Other housekeeping factors that can contribute to accidents are poor illumination and poor floor maintenance. In maintaining floors, care must be taken to clean up spills immediately and ensure that floor cleaners do not leave a slippery surface.

Some actions by employees may cause accidents when combined with housekeeping problems. Employees running or working at undue haste constitutes a hazard. High heeled or platform shoes worn by some workers may be a contributing factor in falling accidents.

Housekeeping can be carried out in such a way as to minimize hazards. Each employee may be given the responsibility for keeping a designated area free from debris and clutter. Joint use areas (aisles, stairs, and storage areas) may be assigned to employees also.

ACTIVITY 7:

The main type of accident associated with poor housekeeping is _____.

OBJECTIVE 8: Compare hazards associated with lifting material by hand as opposed to using machinery.

There are two alternatives for handling material: manual and mechanical. Each method involves some hazards. The hazards related to manual handling include physical strain and stress and potential contact with chemicals, dusts, or sharp objects. Mechanical material handling hazards include overhead loads, shifting loads, unsafe surfaces (for example, unguarded dropoffs on ramps and aisles), and fumes from gasoline-powered systems. In addition, human error in driving is a major potential hazard.

Since manual handling of material will be part of industry far into the future, employees involved in material handling jobs must be prepared to work safely. The following are basic rules to follow:

- Check area around object to be moved and route to be covered. Eliminate obstructions along route.
- Inspect object for slivers, burrs, sharp or jagged edges, and slippery surfaces. Remove these hazards if possible, or overpack object to eliminate contact with such hazards.
- Know contents or material to be lifted. Read label for possible hazardous substances (for example, bags of caustic powders) and comply with label instructions for wearing personal protective equipment (rubber gloves, apron, long-sleeve shirt or protective eye goggles).
- Consider size and weight of object to be lifted (Figure 11). Do not lift more than can be handled; make sure view over and around object is not obscured.
- Wipe off greasy, wet, or slippery objects and keep hands free of oil and grease.
- Keep fingers away from pinch points (ends of pipe or lumber) when setting object down.

- Follow proper lifting principles (feet apart, back straight, chin in, whole hand on grip, elbow and arms in, body weight directly over feet).

Material handling with mechanical systems (forklifts, conveyors, cranes) presents a different set of problems in terms of safety. However, if potentially hazardous liquids or powders are handled, the operator of the mechanically powered system should wear the same personal protective equipment as the operator who manually handles the material. Such precautions are necessary because small spills or excess material on the outside of a bag as well as ruptures of containers can create significant hazards. Operators for mechanical systems should be thoroughly trained, have controlled speeds for operating the system, allow no riders, and be protected with overhead guards.

Figure 11. "Showing off" may be sacrificing safety. People are not usually impressed.

ACTIVITY 8:

Name two hazards associated with mechanically handling materials and two hazards associated with manually handling materials.

1. Mechanical
   a. _____
   b. _____
2. Manual
   a. _____
   b. _____

OBJECTIVE 9: List four types of hazardous electrical conditions and five types of protection against such dangers.

Electricity is so common in American life today that most people are somewhat heedless of its potential hazard. Ordinary electrical power from a 110-120 volt outlet can cause muscle contraction, shock, burns, and death. The human body is a very good conductor of electricity, and unfortunately people are unable to detect electrical signals through their senses until it is too late.

Besides the hazards of shock, electrocution, and the falls that sometimes result from shock, electricity can affect workplace safety by causing ignition of combustible material, overheating and damage to equipment, and inadvertent starting of equipment.

Potential electrical hazards require several types of protection. To protect workers from contact with electricity, insulation such as glass, mica, and plastic is used to separate electrically charged wires and parts from contact with people who use them. In addition, many machines and tools are also grounded by connecting the metal frame of a true ground that is in direct contact with the earth. This prevents an electrical charge from building up between the tool and other grounded equipment or grounded parts of the building. Some tools may be double insulated and require no ground. These tools will be clearly labeled. Insulation and grounding are the first line of defense against electrical shock.

Electrical tools and cords should be kept away from heat, chemicals, or sharp edges that can damage electrical insulation. Electrical equipment should not be used in damp or wet areas. Workers have been known to receive

shocks using power equipment after walking through the rain to work. Wet skin is an excellent conductor of electricity, so water and work with power tools do not mix!

Tools and extension cords should be disconnected by holding the plug, not by pulling on the cord. The control switch on electrical equipment should be on the "off" position before the plug is inserted into or removed from the outlet. Three-prong plugs should always be put into properly installed three-prong sockets. The third prong should never be broken off.

In general, the use of extension cords should be kept to a minimum. The insulation on flexible cords is usually thin and easy to damage by nailing or stapling it into position. Tape is a better material for fixing flexible cord into position.

If tools or cords become warmer than normal during use, the condition should be reported. The insulation could be deteriorating. Cloth should never be wrapped around tools that are too hot to hold because sparks could ignite the cloth. Tools that are obviously damaged - that give off minor shocks or that have exposed live parts - should be reported and taken out of use. Makeshift repairs by persons who are not qualified to repair electrical equipment are an invitation to accidents.

Sometimes a ground connection comes loose without being detected. This is called a ground fault. If a ground fault occurs along with defective insulation, an innocent looking tool can become a deadly shock hazard.

Overcurrent devices - such as fuses and circuit breakers - open the circuit automatically in case of excessive current flow from ground, short circuit, or overload. However, a fuse or circuit breaker will not provide protection against faulty equipment such as the type mentioned above.

A ground fault circuit interrupter (GFCI) is a fast-acting circuit breaker that senses small imbalances in the circuit caused by current leakage to ground. In a fraction of a second a GFCI can shut off the electricity. For maximum protection, a ground fault circuit interrupter (GFCI) should be installed on each electrical circuit.

Combustibles can be ignited by a spark or arc from electrical equipment. In general, it is best to eliminate all electrical circuits and equipment where flammable vapors may exist in a closed room. Equipment can

usually be located outside such areas and electrical wiring and switches routed around it. Another approach is to seal such switches or enclose equipment to such an extent that they are "vapor proof."

Electrically powered equipment generates heat that may cause fires in adjacent material. Rapid overheating may cause explosions of switches, fuses, or circuit breakers. Circuit breakers are designed specifically to prevent such overloading. No one should attempt either to use a different size fuse (usually a larger capacity than the original) or attempt to wire around circuit breakers or block fuses.

Inadvertent activation of an electrical circuit can cause significant injury. Personnel working on electrically operated equipment have been killed when co-workers who were unaware of the repairs in progress sent current to the equipment. Such occurrences are prevented by opening the circuit for the equipment and placing a lock on the switch (a lockout) so it cannot be accidentally closed. In such a case only one person should have a key to the lock, preferably the person performing the electrical work. Lockouts also prevent accidental activation of equipment (by the repairperson) while it is being repaired.

ACTIVITY 9:

1. Circle TRUE or FALSE:

TRUE	FALSE	a.	The third-prong of an electrical plug should never be broken off.
TRUE	FALSE	b.	Several people should be given the key to lockouts in case one of them cannot be found to turn power back on.
TRUE	FALSE	c.	Ordinary electrical power from a 110-120 volt outlet will not kill a person.
TRUE	FALSE	d.	Wet skin is a poor conductor of electricity.
TRUE	FALSE	e.	Faulty equipment can cause shocks, fires, and damage to the equipment itself.
TRUE	FALSE	f.	Falls sometimes result from electrical shock.

2. Name five types of protection against electrical hazards.

a. _____

b. _____

c. _____

d. _____

e. _____

OBJECTIVE 10: Summarize the employee's responsibility for correcting safety hazards.

An effective safety program in the industrial workplace requires cooperation between the employee and the employer. The employee is obligated to comply with all safety and health standards, rules, regulations, or orders issued in accordance with the Occupational Safety and Health Act that are applicable to the employee's own actions.

Beside the legal responsibility to obey OSHA regulations, the employee has another essential role in identifying and reporting hazards to the employer. Employees are often in a position to notice hazards before a supervisor observes them. Conditions such as defective tools or machinery, unguarded pinch points or shear points on machinery, improper lighting and ventilation, electrical problems, and fire hazards should be reported to supervisors as soon as they are discovered.

Workers can exercise a significant degree of control over their own safety through developing and practicing safe work habits. Workers should know and follow correct procedures for their jobs. Maintenance instructions for machinery should be adhered to, and shields and guards should be in place while the machinery is running. Machinery should always be operated within its given capacity, within recommended speeds, and under designated limits. Employees should never operate machinery without being authorized to do so, and they should not remove other workers' lockout devices from switches and switch boxes.

Several aspects of employee safety depend especially upon individual actions by employees. Using proper lifting techniques, choosing the appro-

priate tool and using it correctly, and maintaining a clean work space often fall within the worker's area of responsibility. The wearing of personal protective equipment is another responsibility of the individual worker. Employers may provide hard hats, safety belts, goggles, and other types of personal protective equipment, but only the employee can ensure that this equipment is in the right place to do its job - that is, on the worker's own body.

While unsafe job conditions set the stage for accidents, attitudes often generate the unsafe actions that finally result in injury. Think again of the example given earlier of the worker who cut off a finger while using an unguarded table saw. In this case, the worker's attitude allowed for the breaking of a basic safety principle: be sure that machine cutting points are guarded. Attitude or state of mind is under the individual worker's control. These are some of the states of mind that can contribute to accidents:

- A need to show off or in some cases, to display "manhood" can prompt unsafe acts such as lifting loads that are too heavy, working too quickly, working at heights without proper precautions. Sometimes employees, quite understandably, wish to be seen as especially competent and believe that doing the job without regard for safety is a sign of competence. In reality, employees can learn to build safety into their acts of skill.
- A striving for higher earnings through increased production prompts some employees to bypass safety in favor of speed. If a job is properly engineered, good earnings should be attainable with safe job methods.
- Feelings of insecurity about the job can cause workers to neglect orderly, logical steps in performing tasks because they are trying so hard to prove themselves on the job. Workers need to realize that physical danger in the form of accidents can bring an end to all kinds of security.
- Employees who badly need the approval of their co-workers may give in to group pressure and forego safety. Sometimes experienced employees set a poor example where safety is concerned and pressure new employees to follow their example.
- Problems of inattention frequently cause accidents. Inattention can result from lack of sleep, problems at home, anger about some aspect of the job, and many other stressful life situations. Workers need to try to "leave problems at the door" or where the job is flexible, tackle the least hazardous tasks when they find

themselves preoccupied with other problems. Sometimes the wise course may be to take time off rather than risk an accident.

ACTIVITY 10:

1. State two of the employee's essential responsibilities in maintaining a safe workplace.
   a. _____
   b. _____
2. Name three states of mind that can contribute to accidents.
   a. _____
   b. _____
   c. _____

REFERENCES

Hammer, Willie. Occupational Safety Management and Engineering. Englewood Cliffs, NJ: Prentice-Hall, Inc., 1976.

Heinrich, H.W. et al. Industrial Accident Prevention. New York: McGraw-Hill Book Company, 1980.

National Institute for Occupational Safety and Health. Safety and Health for Industrial/Vocational Education. NIOSH/OSHA, 1981.

National Safety Council. Accident Prevention Manual. 7th ed. Chicago: National Safety Council, 1974.

_____. Handbook of Occupational Safety and Health. Chicago: National Safety Council, 1979.

ANSWERS TO ACTIVITIES

ACTIVITY 1

1. ...to furnish employees a workplace free from recognized hazards that could cause death or serious physical harm.
2. a; b; d; f.

ACTIVITY 2

(Any seven.)

1. Loss of production from the injured worker.
2. Loss of production due to co-workers giving aid and so on.
3. Lowering of morale due to the accident results in decreased production.
4. Time spent by co-workers recovering from the trauma of the accident.
5. Loss of buying power for the victim's family.
6. Welfare payments or rehabilitation costs.
7. Replacement costs of damaged equipment and wasted material.
8. Increased insurance premiums.
9. Loss of production due to damaged equipment.

ACTIVITY 3

1. c.
2. b.

ACTIVITY 4

1. (Any three.)
   a. Unguarded - pinch points on machinery.
      - catch points on sharp edges.
      - shear points.
   b. Defective tools or equipment.
   c. Poor machine design.
   d. Slippery surfaces.
   e. Improper lighting.
   f. Improper ventilation.
   g. Improper dress/clothing.
   h. Poor housekeeping.
   i. Congested area.
   j. Improper protective equipment.

2. (Any three.)
   a. Operating equipment without authority.
   b. Operating equipment at an unsafe speed.
   c. Making safety devices inoperative.
   d. Failing to use personal protective equipment.
   e. Distracting other workers.
   f. Poor housekeeping practices.
   g. Worker horseplay or arguments while working.
   h. Using an improper tool or equipment.
   i. Using a defective tool or equipment.
   j. Standing under suspended loads.
   k. Mounting equipment in motion.
   l. Repairing or maintaining equipment while equipment is operating.
   m. Improper lifting technique.
   n. Working at height without safety devices.

ACTIVITY 5

1. e.
2. c, f.
3. g, a.
4. d.
5. b.

ACTIVITY 6

1. a. Rotating mechanisms - can seize and wind up clothing or hair.
   b. In-running nip points - can catch hair, clothes, or jewelry and draw worker toward machine.
   c. Cutting and shearing - loose clothing or hair can obscure view of cutting hazard.
2. a. Machine guarding.
   b. Personal protective equipment.

ACTIVITY 7

...falling.

ACTIVITY 8

1. Mechanical - (any two of the following): operating or driving hazards, hazardous materials, overhead loads, shifting loads, unsafe surfaces, fumes.
2. Manual - (any two of the following): physical strain, contact with hazardous materials, contact with sharp objects.

ACTIVITY 9

1. a. TRUE.
   b. FALSE.
   c. FALSE.
   d. FALSE.
   e. TRUE.
   f. TRUE.
2. (Any five).
   a. Insulation.
   b. Correct grounding.
   c. Overcurrent devices.
   d. A ground fault circuit interrupter.
   e. Enclosing equipment or sealing switches, located near flammable vapors, to make them "vapor proof."
   f. "Locking-out" circuits that are being worked on.

ACTIVITY 10

1. (Any two.)
   a. To comply with all safety and health regulations, standards, rules, or orders.
   b. To identify and report hazards.
   c. To develop and to practice safe work habits.
2. (Any three.)
   a. A need to show off.
   b. A striving for higher earnings.
   c. Feelings of insecurity.
   d. Co-worker approval.
   e. Inattention.